[0013] FIG. **1**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the first embodiment.

[0014] FIG. **2**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a second embodiment of the present invention.

[0015] FIG. **2**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the second embodiment.

[0016] FIG. **3**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a third embodiment of the present invention.

[0017] FIG. **3**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the third embodiment.

[0018] FIG. **4**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a fourth embodiment of the present invention.

[0019] FIG. **4**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the fourth embodiment.

[0020] FIG. **5**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a fifth embodiment of the present invention.

[0021] FIG. **5**B is a top view illustrating the exemplary configuration of the electromagnetic-wave generation device according to the fifth embodiment.

[0022] FIG. **6**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a sixth embodiment of the present invention.

[0023] FIG. **6**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the sixth embodiment.

[0024] FIG. **6**C is a top view illustrating the exemplary configuration of the electromagnetic-wave generation device according to the sixth embodiment.

[0025] FIG. **7**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to a seventh embodiment of the present invention.

[0026] FIG. **7**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the seventh embodiment.

[0027] FIG. **7**C is a top view illustrating the exemplary configuration of the electromagnetic-wave generation device according to the seventh embodiment.

[0028] FIG. **8**A is a sectional view illustrating an exemplary configuration of an electromagnetic-wave generation device according to an eighth embodiment of the present invention.

[0029] FIG. **8**B illustrates an exemplary band profile of the electromagnetic-wave generation device according to the eighth embodiment.

[0030] FIG. **9** schematically illustrates an exemplary configuration of a terahertz-time-domain spectroscopic system including an electromagnetic-wave generation device.

[0031] FIG. **10** schematically illustrates a known electromagnetic-wave generation apparatus.

DESCRIPTION OF THE EMBODIMENTS

[0032] In an electromagnetic-wave generation device according to an embodiment of the present invention, carriers of an emitter section including a first electrode are excited by being irradiated with light, and go beyond a potential barrier including a second semiconductor formed in contact with a first semiconductor constituting a carrier-travel section. Consequently, the carriers are accelerated with the carrier-travel section. Since the second semiconductor, which constitutes the potential barrier of the emitter section, is in contact with the first semiconductor, it becomes possible to stabilize the travel distance of each of the carriers and avoid the adhesion of an adsorption material to the surface of the carrier-travel section. Along these lines of thought, the electromagnetic-wave generation device is basically configured as described above.

[0033] Although the irradiation light is time-modulated light in ordinary cases, the irradiation light may be continuous light. In the case where the continuous light is used, light having two types of frequencies, where the difference between the frequencies falls within the terahertz area, is used as the irradiation light. Further, for setting the ballistic-flight distance of an electron (or a hole) with increased precision, the carrier-travel section may include the first semiconductor having a length not more than a mean free path defined along the direction in which the carriers travel. Further, the carrier-travel section may be provided as the first semiconductor including an intrinsic or substantially intrinsic semiconductor.

[0034] Hereinafter, embodiments of the present invention will be described with reference to the attached drawings.

First Embodiment

[0035] An electromagnetic-wave generation device according to a first embodiment of the present invention will be described with reference to FIGS. **1**A and **1**B. FIG. **1**A is a sectional view of the electromagnetic-wave generation device of the present embodiment. FIG. **1**B illustrates a band profile obtained along a section of the electromagnetic-wave generation device of the present embodiment. Each of FIGS. **1**A and **1**B illustrates a first electrode **101** provided to supply an electron to the emitter section and a semiconductor-potential barrier **102** including a semiconductor (second semiconductor) which is thick enough not to allow an electron (or a hole) to tunnel through the semiconductor. In the present embodiment, both the electrode **101** and the semiconductor-potential barrier **102** constitute the emitter section. Therefore, the semiconductor-potential barrier **102** is designed so that the height thereof is slightly lower than the photon energy of excitation light **131** which will be described later with respect to the Fermi energy of the electrode **101**.

[0036] A carrier-travel section **103** includes an intrinsic or substantially intrinsic semiconductor (a first semiconductor) thinner than the mean free path. Usually, the thickness of the semiconductor is of the order of 10 nm to 100 nm at ambient temperatures. The expression "substantially intrinsic" indicates that the semiconductor may not be thoroughly intrinsic. That is, the electron (or hole) density of the semiconductor should be low enough that an electric field can be applied to the semiconductor. Usually, the value of the electron (or hole) density may be 10^{16} cm^{-3} or less. The carrier-travel section **103** is in contact with the semiconductor-potential barrier **102**, and the interface between the carrier-travel section **103** and the semiconductor-potential barrier **102** is not exposed to the ambient atmosphere. Consequently, the adhesion of an adsorption material or the like to the surface of the carrier-travel section is reduced. A second electrode **111** is provided to extract an electron from a collector section. In the present embodiment, only the electrode **111** constitutes the collector section.